

Kindergarten Science-Technology-Engineering

Introduction: The diocesan Science-Technology-Engineering curriculum guidelines are adapted from the Next Generation Science Standards (NGSS) [<http://www.nextgenscience.org/>] and are based on the 2016 MA Science & Technology/Engineering Framework (MA STE) [available: <http://www.doe.mass.edu/frameworks/current.html> and in separate sections along with other resources at <http://www.doe.mass.edu/stem/review.html>] These resources should be explored since they include a wealth of information beyond the standards. The diocesan guidelines use the same numbering system for the standards in order to facilitate searches for lessons and other resources. A standard followed by an asterisk “*” indicates an engineering design practice. The order of the standards does not imply a recommended instructional sequence. “Common Core Connections” from NGSS are included for grades K-5 to suggest ways to include science in other subjects (and vice versa.) “Not included from NGSS”, “Clarification Statements” and the set of standards themselves are not intended to be restrictive in any way. Consideration should be given to the Pre-Kindergarten curriculum guidelines when planning.

Grades Pre-K–2: Overview of Science and Engineering Practices: The development of science and engineering practices begins very early, even as babies and young children inquire about and explore how the world works. Formal education should advance students’ development of the skills necessary to engage in scientific inquiry and engineering design. These are the skills that provide the foundation for the scientific and technical reasoning that is so critical to success in civic life, postsecondary education, and careers. Inclusion of science and engineering practices in standards only speaks to the types of performances students should be able to demonstrate at the end of instruction at a particular grade; the standards do not limit what educators and students should or can be engaged in through a well-rounded curriculum.

Pre-K through grade 2 standards integrate all eight science and engineering practices. Pre-K standards ask students to demonstrate an ability to ask questions, set up simple investigations, analyze evidence, observations, and data for patterns, and use evidence to explain or develop ideas about how phenomena work. Kindergarten standards call for students to show further development of investigation and communication skills, as well as application of science concepts to designing solutions to problems, and to now use information obtained from text and media sources. Grade 1 standards call for students to continue developing investigation skills, including their ability to pose scientific questions as well as their ability to analyze observations and data and to effectively use informational sources. Grade 1 standards also call for students to demonstrate their ability to craft scientific explanations using evidence from a variety of sources. Grade 2 standards call for students to use models in a scientific context and further their skills in a number of the practices, including investigations, data analysis, designing solutions, argumentation, and use of informational sources.

Some examples of specific skills students should develop in these grades:

1. Raise questions about how different types of environments provide homes for living things; ask and/or identify questions that can be answered by an investigation.
2. Use a model to compare how plants and animals depend on their surroundings; develop and/or use a model to represent amounts, relationships, and/or patterns in the natural world; distinguish between a model and the actual object and/or process the model represents.
3. Conduct an investigation of light and shadows; plan and conduct an investigation collaboratively to produce data to answer a question; make observations and/or relative measurements to collect data that can be used to make comparisons.
4. Analyze data to identify relationships among seasonal patterns of change; use observations to describe patterns and/or relationships in the natural world and to answer scientific questions.
5. Decide when to use qualitative vs. quantitative information; use counting and numbers to describe patterns in the natural world.
6. Use information from observations to construct an evidence-based account of nature.

7. Construct an argument with evidence for how plants and animals can change the environment; distinguish between opinions and evidence in one's own explanations; listen actively to others to indicate agreement or disagreement based on evidence.
8. Obtain information to compare ways that parents and their offspring behave to survive; obtain information using various texts, text features, or other media to answer a question.

While presented as distinct skill sets, the eight practices intentionally overlap and interconnect. Skills such as those outlined above should be reflected in curricula and instruction that engage students in an integrated use of the practices.

Kindergarten Focus - Reasons for Change: In kindergarten, students build on early experiences observing the world around them as they continue to make observations that are more quantitative in nature and help them identify why some changes occur. Students begin to learn to use these observations as evidence to support a claim through growing language skills. They learn that all animals and plants need food, water, and air to grow and thrive and that the fundamental difference between plants and animals is a plant's ability to make its own food. Students build their quantitative knowledge of temperature in relation to the weather and its effect on different kinds of materials. They observe that the amount of sunlight shining on a surface causes a temperature change and they design a structure to reduce the warming effects of sunlight. They investigate motions of objects by changing the strength and direction of pushes and pulls. They provide examples of plants and animals that can change their environment through their interactions with it. In kindergarten science, students begin to identify reasons for changes in some common phenomena.

Kindergarten: Earth and Space Sciences

ESS2. Earth's Systems

Students who demonstrate understanding can:

K-ESS2-1. Use and share quantitative observations of local weather conditions to describe patterns over time.

Clarification Statements: Examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month, and relative temperature. Quantitative observations should be limited to whole numbers.

K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment.

Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digging holes in the ground and tree roots that break concrete.

Common Core Connections:

ELA/Literacy – RI.K.1 With prompting and support, ask and answer questions about key details in a text. (K-ESS2-2) **W.K.1** Use a combination of drawing, dictating, and writing to compose opinion pieces in which they tell a reader the topic or the name of the book they are writing about and state an opinion or preference about the topic or book. (K-ESS2-2) **W.K.2** Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic. (K-ESS2-2) **W.K.7** Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). (K-ESS2-1) **Mathematics – MP.2** Reason abstractly and quantitatively. (K-ESS2-1) **MP.4** Model with mathematics. (K-ESS2-1) **K.CC.A** Know number names and the count sequence. (K-ESS2-1) **K.MD.A.1** Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. (K-ESS2-1) **K.MD.B.3** Classify objects into given categories; count the number of objects in each category and sort the categories by count. (K-ESS2-1)

ESS3. Earth and Human Activity

K-ESS3-2. Obtain and use information about weather forecasting to prepare for, and respond to, different types of local weather.

K-ESS3-3. Communicate solutions to reduce the amount of natural resources an individual uses.*

Clarification Statement: Examples of solutions could include reusing paper to reduce the number of trees cut down and recycling cans and bottles to reduce the amount of plastic or metal used.

Not included from NGSS: K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

Common Core Connections: ELA/Literacy – RI.K.1 With prompting and support, ask and answer questions about key details in a text. (K-ESS3-2) **W.K.2** Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic. (K-ESS3-3) **SL.K.3** Ask and answer questions in order to seek help, get information, or clarify something that is not understood. (K-ESS3-2) **SL.K.5** Add drawings or other visual displays to descriptions as desired to provide additional detail. (K-ESS3-1) **Mathematics – MP.2** Reason abstractly and quantitatively. (K-ESS3-1) **MP.4** Model with mathematics. (K-ESS3-1),(K-ESS3-2) **K.CC** Counting and Cardinality (K-ESS3-1),(K-ESS3-2)

Kindergarten: Life Science

LS1. From Molecules to Organisms: Structures and Processes

K-LS1-1. Observe and communicate that animals (including humans) and plants need food, water, and air to survive. Animals get food from plants or other animals. Plants make their own food and need light to live and grow.

K-LS1-2(MA). Recognize that all plants and animals grow and change over time.

Common Core Connections: ELA/Literacy – W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). (K-LS1-1) **Mathematics – K.MD.A.2** Directly compare two objects with a measurable attribute in common, to see which object has “more of”/”less of” the attribute, and describe the difference. (K-LS1-1)

Kindergarten: Physical Science

PS1. Matter and Its Interactions

K-PS1-1(MA). Investigate and communicate the idea that different kinds of materials can be solid or liquid depending on temperature.

Clarification Statements: Materials chosen must exhibit solid and liquid states in a reasonable temperature range for kindergarten students (e.g., 0–80°F), such as water, crayons, or glue sticks. Only a qualitative description of temperature, such as hot, warm, and cool, is expected.

PS2. Motion and Stability: Forces and interactions

K-PS2-1. Compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

Clarification Statements: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other. Comparisons should be on different relative strengths or different directions, not both at the same time. Non-contact pushes or pulls such as those produced by magnets are not expected.

*Not included from NGSS: K-PS2-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.**

Common Core Connections: ELA/Literacy – RI.K.1 With prompting and support, ask and answer questions about key details in a text. (K-PS2-2) **W.K.7** Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). (K-PS2-1) **SL.K.3** Ask and answer questions in order to seek help, get information, or clarify something that is not understood. (K-PS2-2) **Mathematics – MP.2** Reason abstractly and quantitatively. (K-PS2-1) **K.MD.A.1** Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. (K-PS2-1) **K.MD.A.2** Directly compare two objects with a measurable attribute in common, to see which object has “more of/less of” the attribute, and describe the difference. (K-PS2-1)

PS3. Energy

K-PS3-1. Make observations to determine that sunlight warms materials on Earth’s surface.

Clarification Statements: Examples of materials on Earth’s surface could include sand, soil, rocks, and water. Measures of temperature should be limited to relative measures such as warmer/cooler.

K-PS3-2. Use tools and materials to design and build a model of a structure that will reduce the warming effect of sunlight on an area.*

Common Core Connections: ELA/Literacy – W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). (K-PS3-1),(K-PS3-2) **Mathematics – K.MD.A.2** Directly compare two objects with a measurable attribute in common, to see which object has “more of/less of” the attribute, and describe the difference. (K-PS3-1),(KPS3-2)